



**US Army Corps
of Engineers.**
Construction Engineering
Research Laboratory

Fact Sheet

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BUILDING LOADS ANALYSIS AND SYSTEM THERMODYNAMICS (BLAST)

The Problem

During design phase of a building, many decisions are made that affect the energy consumption and cost over the life-cycle of the facility. If changes in the facility design can be made early, a more cost-effective, energy-conservative building can result. Due to the complexity of building interactions, a computerized means for predicting energy consumption and system performance is necessary. For such a program to be comprehensive and account for complex technologies, such as ice storage, an hour by hour analysis is required.

The Technology

The U.S. Army Construction Engineering Research Laboratory (CERL) developed the Building Loads Analysis and System Thermodynamics (BLAST) program to investigate the energy performance of new or retrofit building design options of almost any type and size. In addition to performing peak load (design day) calculations necessary for mechanical equipment design, BLAST also estimates a facility's annual energy performance, which is essential for the design of solar and total energy (cogeneration) systems and for determining compliance with design energy budgets.

The BLAST analysis program encompasses three major subprograms which compute hourly requirements of the space loads, calculates demands (hot water, steam, gas, electrical, chilled water) of the building and air-handling systems, and computes the hourly annual fuel and electrical power consumptions.

The heart of space loads prediction is the room heat balance. For each hour simulated, BLAST performs a complete radiant, convective, and conductive heat balance for each surface of each zone described and a heat balance on the room air. This heat balance includes transmission loads, solar loads, internal heat gains, infiltration loads, and the temperature control strategy used to maintain the space temperature. A companion program, the Life-Cycle Cost in Design (LCCID), provides life-cycle calculations. User inputs include building construction and operating costs (excluding energy), fan system construction and maintenance costs, and user supplied and default capital and maintenance costs for plant components. In addition, users may select appropriate fuel cost adjustment factors as well as discount and inflation rates.

Benefits/Savings

Since repeated use of BLAST is inexpensive, it can be used to evaluate, modify, and reevaluate alternate designs on the basis of annual energy consumption and cost. In this way, efficient designs can be separated from the inefficient; proper equipment type, size, and control can also be determined. Near optimal designs for any new or retrofit project can be developed using this approach.

Status

The BLAST family of programs is maintained and enhanced through direction from the BLAST users. New windows interfaces for BLAST and LCCID are currently under release. Training in the use of BLAST may be obtained through the BLAST Support Office. Currently, BLAST technology is being incorporated into the DOE (Department of Energy) funded EnergyPlus (ref Fact Sheet CF-6).

Points of Contact

CERL POC is Ms. Linda Lawrie, COMM 217-373-7260; toll-free 800-USA-CERL; FAX 217-373-6724; email http://www.l-lawrie@cecer.army.mil; or CERL, ATTN: CECER-CF-N, P.O. Box 9005, Champaign, IL 61826-9005.

The documentation for the BLAST system, as well as the program, is available from the BLAST Support Office, COMM 217-333-3977; or University of Illinois, 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, IL 61801.

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